

Amendments to the Claims

This listing of claims will replace all prior versions, and listings of claims in the application.

1. (cancelled)

2. (currently amended) The package of claim + 54, further comprising:
a plurality of solder balls attached to said second surface of said substrate.

3. (currently amended) The package of claim + 54, wherein said heat spreader is
configured to dissipate heat generated by said IC die.

4. (cancelled)

5. (currently amended) The package of claim + 54, wherein a said second
surface of said heat spreader is configured to be attached to a printed circuit board.

6. (currently amended) The package of claim + 54, wherein said contact
pad is a ground contact pad, and wherein said heat spreader operates as a ground plane.

7. (cancelled)

8. (cancelled)

9. (currently amended) The package of claim + 54, wherein said stiffener includes a central cavity in said surface of said stiffener, wherein said central cavity forms at least a portion of said accessible portion of said surface of said stiffener, wherein said IC die is mounted in said central cavity.

10. (currently amended) The package of claim + 54, wherein said surface of said stiffener is substantially planar, and wherein said accessible portion of said surface of said stiffener is centrally located on said surface of said stiffener.

11. (currently amended) The package of claim + 54, wherein said IC die is mounted to said surface of said stiffener with a first epoxy layer, and wherein said heat spreader is mounted to said IC die with a second epoxy layer.

12. (currently amended) The package of claim + 54, wherein an area of said second surface of said IC die is greater than an area of a said first surface of said heat spreader, and wherein said heat spreader is configured to mount to the center of said second surface of said IC die.

13. (currently amended) The package of claim + 54, wherein said IC die and said heat spreader are encapsulated.

14. (currently amended) The package of claim ~~1~~ 54, wherein said IC die and a portion of said heat spreader are encapsulated by an encapsulant material, wherein a said second surface of said heat spreader is exposed through said encapsulant material.

15. (previously amended) The package of claim 14, wherein said heat spreader includes a circumferential surface between said first and said second surfaces of said heat spreader, wherein said circumferential surface is at least partially exposed.

16. (currently amended) The package of claim ~~1~~ 54, wherein said substrate is a tape substrate.

17. (currently amended) The package of claim ~~1~~ 54, wherein said stiffener and said heat spreader have the same thermal expansion coefficient.

18. (cancelled)

19. (currently amended) The method of claim ~~18~~ 57, further comprising the step of:

attaching a plurality of solder balls to the second surface of the substrate.

20. (cancelled)

21. (currently amended) The method of claim 20 57, further comprising the step of:

configuring a the second surface of the heat spreader to be attached to a printed circuit board.

22. (currently amended) The method of claim 22 57, wherein the contact pad is a ground contact pad, further comprising the step of:

coupling the ground contact pad to the heat spreader with the wire bond, wherein the heat spreader operates as a ground plane.

23. (currently amended) The method of claim 20 57, wherein said heat spreader mounting step comprises the step of:

providing a heat spreader that ~~has a first planar surface, wherein the heat spreader has a second planar surface, wherein the first and the second planar surfaces are substantially parallel to each other, wherein the heat spreader has a ridge around at least a portion of its circumference such that an area of the first planar surface~~ of the heat spreader is greater than that of the second ~~planar surface~~ of the heat spreader.

24. (cancelled)

25. (currently amended) The method of claim 18 57, wherein said stiffener providing step comprises the step of:

forming a central cavity in the surface of the stiffener, wherein the central cavity forms at least a portion of the accessible portion of the surface of the stiffener.

26. (original) The method of claim 25 wherein said IC die first surface mounting step comprises the step of:

mounting the IC die in the central cavity.

27. (currently amended) The method of claim ~~18~~ 57, wherein said heat spreader mounting step comprises the step of:

providing a heat spreader that is substantially planar, wherein the surface of the stiffener is substantially planar, wherein the accessible portion of the stiffener is centrally located on the substantially planar stiffener surface.

28. (currently amended) The method of claim ~~18~~ 57, wherein said IC die first surface mounting step comprises the step of:

mounting the first surface of the IC die to the stiffener with a first epoxy layer, wherein the heat spreader is mounted to the IC die with a second epoxy layer.

29. (currently amended) The method of claim ~~18~~ 57, wherein an area of the second surface of the IC die is greater than an area of the first surface of the heat spreader, further comprising the step of:

configuring the heat spreader to mount to the center of the second IC die surface.

30. (currently amended) The method of claim ~~18~~ 57, further comprising the step of:

encapsulating the IC die and the heat spreader.

31. (currently amended) The method of claim 30, wherein said encapsulating step comprises the step of:

allowing the ~~exposing~~ a second surface of the heat spreader to be exposed
through an encapsulant material.

32. (previously amended) The method of claim 31, wherein said exposing step comprises the step of:

exposing at least a portion of a circumferential surface of the heat spreader
through the encapsulant material.

33. (currently amended) The method of claim ~~18~~ 57, wherein the substrate is a tape substrate, wherein said substrate providing step comprises the step of:

providing the tape substrate.

34. (currently amended) The method of claim ~~18~~ 57, further comprising the step of:

matching a thermal expansion coefficient of the stiffener to the thermal expansion coefficient of the heat spreader.

35. (currently amended) A system for assembling a ball grid array (BGA) package, comprising:

~~—— a substrate that has a first surface and a second surface, wherein the substrate has a central window-shaped aperture that extends through the substrate from the first substrate surface to the second substrate surface;~~
~~—— a stiffener;~~

means for attaching a surface of ~~the~~ a stiffener to a first surface of a substrate ~~the first substrate surface, wherein the substrate has a window-shaped aperture that extends through the substrate from the first surface of the substrate to a second surface of the substrate,~~ wherein a portion of the stiffener is accessible through the ~~central~~ window-shaped aperture;

means for mounting a first surface of an IC die to the accessible portion of the stiffener; ~~and~~

means for mounting a surface of a heat spreader to a second surface of the IC die; and

means for coupling a contact pad of the IC die to a ridge of the heat spreader between the first surface and a second surface of the heat spreader with a wire bond.

36. (previously amended) The system of claim 35, wherein the substrate is a tape substrate.

37. (currently amended) The package of claim ~~+~~ 54, wherein said heat spreader comprises at least one metal.

38. (previously presented) The package of claim 37, wherein said at least one metal includes copper.

39. (previously presented) The package of claim 37, wherein said at least one metal includes aluminum.

40. (currently amended) The package of claim † 54, wherein said heat spreader is electrically conductive.

41. (currently amended) The package of claim † 54, further comprising:
an encapsulant material that encapsulates said IC die and said heat spreader on said ~~second~~ surface of said stiffener.

42. (currently amended) The package of claim † 54, wherein said stiffener is a second heat spreader.

43. (currently amended) The package of claim † 54, further comprising:
a thermally conductive adhesive material that attaches said first surface of said heat spreader to said second surface of said IC die.

44. (currently amended) The package of claim † 54, further comprising:
an electrically conductive adhesive material that attaches said first surface of said heat spreader to said second surface of said IC die.

45. (previously presented) The package of claim 41, wherein said encapsulant material is used to maintain said heat spreader in contact with said second surface of said IC die.

46. (currently amended) The package of claim 41, further comprising:
an encapsulant material that encapsulates said IC die and a portion of said heat spreader on said ~~second~~ surface of said stiffener.

47. (currently amended) The package of claim 46, wherein ~~a substantially planar~~ said second surface of said heat spreader is not encapsulated by said encapsulant material and is accessible.

48. (currently amended) The package of claim 46, wherein said heat spreader includes ~~opposing first and second surfaces, and further includes~~ a circumferential surface between said first and second surfaces of said heat spreader, ~~wherein said first surface of said heat spreader is attached to said second surface of said IC die,~~ wherein said second surface of said heat spreader and a portion of said circumferential surface are not encapsulated by said encapsulant material and are accessible.

49. (currently amended) The package of claim ~~4~~ 54, wherein said heat spreader includes:

~~— a first surface of said heat spreader that is attached to said second surface of said IC die;~~

~~— a second surface of said heat spreader opposed to said first surface of said heat spreader and having an area less than an area of said first surface of said heat spreader;~~

a circumferential surface around said heat spreader that connects said first and said second surfaces of said heat spreader; and

wherein said a ridge is opposed to said second surface of said heat spreader ~~formed between said first and second surface of said heat spreader~~ in said circumferential surface.

50. (currently amended) The package of claim ~~1~~ 54, wherein said heat spreader is substantially rectangular in shape, ~~being defined by opposing first and second surfaces,~~ ~~wherein said first surface of said heat spreader is attached to said second surface of said IC die;~~

51. (previously presented) The package of claim 50, wherein said second surface of said heat spreader is capable of being attached to a contact area on a printed circuit board when the BGA package is mounted to the printed circuit board.

52. (previously presented) A ball grid array (BGA) package, comprising:

a stiffener/heat spreader;

a substrate that has a first surface and a second surface, wherein said substrate has a central window-shaped aperture that extends through said substrate from said first substrate surface to said second substrate surface, wherein said first substrate surface is attached to a surface of said stiffener/heat spreader, wherein a portion of said

stiffener/heat spreader is accessible through said central window-shaped aperture;

an IC die that has a first surface and a second surface, wherein said first IC die surface is mounted to said accessible portion of said stiffener/heat spreader, wherein said second IC die surface includes a contact pad;

a drop-in heat spreader that has a surface that is mounted to said second IC die surface; and

a wire bond that couples said contact pad to said drop-in heat spreader;

wherein said first surface of said drop-in heat spreader is planar, wherein said drop-in heat spreader has a second planar surface, wherein said first and said second planar surfaces are substantially parallel to each other, wherein said drop-in heat spreader has a ridge around at least a portion of its circumference such that an area of said first planar surface is greater than that of said second planar surface; and

wherein said wire bond attaches to said ridge of said drop-in heat spreader.

53. (previously presented) A method of assembling a ball grid array (BGA) package, comprising the steps of:

providing a substrate that has a first surface and a second surface, wherein the substrate has a central window-shaped aperture that extends through the substrate from the first substrate surface to the second substrate surface;

providing a stiffener/heat spreader;

attaching a surface of the stiffener/heat spreader to the first substrate surface, wherein a portion of the stiffener/heat spreader is accessible through the central window-shaped aperture;

mounting a first surface of an IC die to the accessible portion of the stiffener/heat spreader, wherein the second IC die surface includes a contact pad; and

mounting a surface of a drop-in heat spreader to a second surface of the IC die, including the step of providing a drop-in heat spreader that has a first planar surface, wherein the drop-in heat spreader has a second planar surface, wherein the first and the second planar surfaces are substantially parallel to each other, wherein the drop-in heat spreader has a ridge around at least a portion of its circumference such that an area of the first planar surface is greater than that of the second planar surface; and

coupling the contact pad to the drop-in heat spreader with a wire bond, including the step of attaching the wire bond to the ridge of the drop-in heat spreader.

54. (New) A ball grid array (BGA) package, comprising:

a stiffener;

a substrate that has a first surface and a second surface, wherein said substrate has a window-shaped aperture that extends through said substrate from said first substrate surface to said second substrate surface, wherein said first surface of said substrate is attached to a surface of said stiffener, and wherein a portion of said surface of said stiffener is accessible through said window-shaped aperture;

an IC die that has a first surface and a second surface, wherein said first surface of said IC die surface is mounted to said accessible portion of said surface of said stiffener;

a heat spreader that has opposing first and second surfaces, wherein said first surface of said heat spreader is mounted to said second surface of said IC die, wherein said heat spreader has a ridge between said first and second surfaces of said heat

spreader; and

at least one wire bond that couples at least one contact pad of said IC die to said ridge of said heat spreader.

55. (New) The package of claim 54, wherein said ridge extends around a portion of the circumference of the heat spreader.

56. (New) The package of claim 54, wherein said ridge extends around the heat spreader.

57. (New) A method of assembling a ball grid array (BGA) package, comprising the steps of:

providing a substrate that has a first surface and a second surface, wherein the substrate has a window-shaped aperture that extends through the substrate from the first surface of the substrate to the second surface of the substrate;

providing a stiffener;

attaching a surface of a stiffener to the first surface of the substrate, wherein a portion of the surface of the stiffener is accessible through the window-shaped aperture;

mounting a first surface of an IC die to the accessible portion of the surface of the stiffener;

mounting a first surface of a heat spreader to a second surface of the IC die; and
coupling a contact pad of the IC die to a ridge of the heat spreader between the first surface and a second surface of the heat spreader with a wire bond.